REMARKS

Claims 1-8, all the claims pending in the application, stand rejected. Applicant hs amended independent claims 1, 3, 4, 7 and 8, in order to focus on the subject matter that the Examiner has indicated may be patentable.

Specification

The Examiner has objected to the disclosure because of certain informalities that have been specifically identified. Upon Applicant's review of the specification, other text also was identified that could be clarified. All of these informalities have been corrected.

Claim Rejections - 35 USC 102

Claims 1-3, 4, 7 and 8 are rejected under 35 USC 102(b) as being anticipated by multiple patents teaching ultrasound transducer array devices. This rejection is traversed for at least the following reasons

The invention defined by claims 1-3 concerns an ultrasonic probe to be used when connected to an external apparatus main body. The probe comprises a two dimensional transducer array including plural ultrasonic transducers and connector, having plural electrodes, for connecting ultrasonic transducers selected from among the plural ultrasonic transducers to the external apparatus main body. As recited in claim 1, the probe has an identification holding means that holds arrangement information and/or characteristic information on the selected ultrasonic transducers within said transducer array. The claim now has been amended to recite that the transducers comprise "elements in an original pattern that are determined to be working and elements in a reconfigured pattern that includes additional elements outside of said original pattern that are determined to be working."

As recited in claim 3, at least two kinds of connecting relationships between the selected ultrasonic transducers and the plural electrodes are set up in regard to plural ultrasonic probes. Claim 3 has been amended similarly to state that the transducers comprise elements in an original pattern that are determined to be working and elements in a reconfigured pattern that includes additional elements outside of said original pattern that are determined to be working.

Claim 7 is directed to an ultrasonic transmitting and receiving apparatus used with a probe as defined in claim 1, while claim 8 is directed to an ultrasonic transmitting and receiving apparatus used with a probe as defined in claim 3. This subject matter is taught at least at pages 8-12 with regard to Figs. 1 and 2. Claim 7 has been amended in a manner similar to that of claim 3.

The Examiner has cited a large number of prior art references against the subject matter of claims 1, 2 and 7, including Tsuchiko et al (5,251,631), Okada et al (5,657,761), Magrane (4,893,284), Ikeda et al (4,811,740) and Snyder et al (6,120,449). With respect to Snyder et al, the Examiner points to elements 24, 36, 56-60 as being on board the probe which feeds through the system connector and updates the flash memory 58 to bridge or short defective elements in a two dimensional array in order to increase manufacturing yield. The Examiner observes that Snyder et al concerns a type of probe **defective element re-optimization**. The Examiner also observes that Snyder et al supplies channel specific phase data to the beam former, which is "tantamount to delay control via the connector ID" (with reference to col. 9, line 66-col. 10, line 9).

The Examiner has cited numerous references against the subject matter of claims 3 and 8, including Uchiumi et al (5,092,337), Brock-Fisher (6,500,126) and Snyder (5,520,187). As to these claims, the Examiner considers them directed to a probe identifier assigned during manufacture and used to locally invoke problem arrangement delay and connections useable information in either a locally stored disk 28 or retrievable over a network (page 22 and 23). The Examiner then interprets the claims broadly as relating to arrays of systems having configurable connectors to accommodate different probes.

However, on the basis of the amendments made to claims 1, 3 and 7, Applicants respectfully submit that the rejection is now overcome.

Claim Rejections - 35 USC 103

Claims 2 and 3 are rejected under 35 USC 103(a) as being unpatentable over any of the multiple patents teaching ultrasound transducer array devices as previously identified,

in combination with Brisken et al (5,209,235). This rejection also is traversed for at least the following reasons.

The Examiner takes the position that the binarization of a digital identification circuit is shown with respect to circuit 26 in Brisken as well as the illustrations in Figs. 6A-6D and the disclosure of col. 3, line 66-col. 4, line 6 in order to transfer identification information without advanced logic to interpret the information.

On the basis of the amendments made to claims 1 and 3, this rejection should be overcome.

Claim 4 is rejected under 35 USC 103(a) as being unpatentable over Snyder et al in view of Haider (6,565,510). This rejection is traversed for at least the following reasons.

Claim 4 is directed to an ultrasonic transmitting and receiving apparatus having a control means for controlling delay amounts of the plural driving signals in plural transmitting circuits and/or delay amounts of the plural detection signals in plural receiving circuits in correspondence with the ultrasonic probe identified on the basis of the identification information.

In framing the rejection, the Examiner first looks to a narrow interpretation of the claims to find that the provision of phase information to the beam former in Snyder et al is not the same as providing delay information. But the Examiner concludes that it would have been obvious in view of Haider (col. 8, lines 9-55) to re-optimize delay or individualize delay profiles based upon the presence of defective elements, since Haider is also interested in increasing the service usability of ultrasound imaging arrays and recognizes that remote re-optimization was equivalent to local re-configuration of earlier approaches as in Snyder et al (col. 10, lines 57-63).

Applicant has amended claim 4 to recite that the transducers comprise "elements in an original pattern that are determined to be working and elements in a reconfigured pattern that includes additional elements outside of said original pattern that are determined to be working." This feature is not found in the cited art..

Claims 5-6 are is rejected under 35 USC 103(a) as being unpatentable over Tsuchiko et al (5,251,631) or Snyder et al in view of Haider (6,565,510), Magrane (4,893,284) and

further in view of Ikeda et al (4,811,740). The claims also are considered to be unpatentable over Ikeda et al alone. Claims 5 and 6 depend from claim 4. This rejection is traversed for at least the following reasons.

The Examiner notes that Ikeda et al states at col. 1, lines 29-46 that one may pre-store the entire body of channel delay information of a batch or population of probes for subsequent readout if memory is sufficiently large. The Examiner concludes that it would have been obvious to consider such possibility as memory became cheaper.

These claims would be patentable on the basis of their dependence from claim 4, which has been amended to incorporate features not found in the prior art, as noted above.

Examiner's Patentability Assessment

The Examiner has provided a "Patentability Assessment" beginning at page 6 of the Office Action in which the Examiner identifies two approaches in the prior art that are known to optimize or configure an array of transducer working elements in order to avoid problems with defective or dead elements.

The first approach identified at page 7 is divided into two lines, those followed by Snyder et al (US 6,120,449) where a "narrow issue" of probe-ID based re-optimization of array operation in the face of defective elements is described. The Examiner asserts that Snyder et al in combination with Haider (US 6,565,510) and/or Ikeda et al (4,811,740) are relevant to the narrow issue. In addition, the Examiner looks to the non-Snyder references which address the "broad issue" of probe connector characterizing information storage or an individual probe based system configurations.

The second approach concerns "compensation optimization for defective elements and re-optimization of a sparse array of random or pseudo random type" having defective transducers. The Examiner cites patents to Fink (5,092,336), Burke et al (5,517,994), Yao (5,676,149), Snyder et al (6,120,449), Haider (6,565,510) and Sasaki et al (6,656,119) as relevant. These are considered as teaching defective transducer element compensation/re-optimization in general. With respect to sparse arrays of random or pseudo random type, the Examiner refers to the Davidson et al citations in the IDS as well as Steinberg et al (5,808,962),

Sumanaweera et al (6,503,204), Song (5,893,832), Holm (6,279,399), Chiang et al (6552,964) and Grenon et al (6,783,497).

At page 10 of the Office Action, the Examiner notes that with respect to general optimization for defective transducers, the prior art does not teach or suggest an ultrasound system which re-optimizes or reconfigures in the face of defective elements by selecting at least some elements other than the originally selected one among still working elements for array re-optimization. The Examiner notes that this broad principle is not disclosed with respect to whether primary information about the element defects resides in a "smart probe connector", the system controls memory, a remote site, or forwarded pre-calibrations from the probe manufacturing process.

Applicant understands the Examiner's comment to be directed to the subject matter illustrated in Figs. 9-11, as disclosed at pages 17-22. In particular, with regard to Fig. 9, it is noted that an initial **transmission area** is defined by plural concentric rings i and further defined by quadrants I-IV (parameter j). This initial transmission area contains transducers in an optimal transmission pattern as illustrated in Fig. 3A. Following an analysis that identifies elements in the initial area that are considered defective, the transmission area is expanded by additional rings up to a ring i_{max}. These supplemental rings define a new transmission area where elements to be used are arranged by considering defective elements. The process for reconfiguring the transmission area is illustrated in Fig. 10 and a determination of whether the maximum number of rings has been met is determined just prior to step S16. As explained at page 20, if the number of defective elements in the initial area (Nc) is less than or equal to the number of non-defective elements in the area adjacent outside of the initial area, a determination of non-defective elements to be used in the area is made according to random numbers in step S17.

Fig. 11 also show a flowchart with an algorithm for determining the arrangement pattern of the ultrasonic transducers for **reception area**, while avoiding the defective elements. In a similar fashion to that used for the transmission pattern, if the number of ultrasonic transducers in the area (Nt (i, j)) is equal to or larger than the sum of the number (Nu (i, j)) of the non-defective elements to be used in the area ij and the number (Nn (i, j)) of defective elements in the area a (i, j) then a determination of elements to be used according to an arrangement pattern

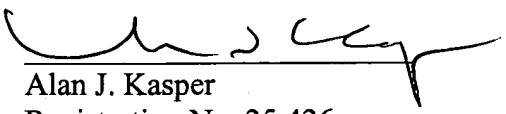
while avoiding positions of defective elements is made in step S22. Once the maximum number of rings ($i = i_{max}$) is reached, the process comes to end.

Applicant understands the Examiner's comment to be a suggestion that this optimization or reconfiguration process is distinct with respect to the prior art. Thus, in view of the absence of any teaching of the optimization and reconfiguration approach, Applicant has amended the claims to capture this feature. As already noted, all of the claims now recite that the transducers comprise "elements in an original pattern that are determined to be working and elements in a reconfigured pattern that includes additional elements outside of said original pattern that are determined to be working."

In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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